ANSWERS: Crystal Ball questions on Combustion

organic molecule	equation for complete combustion	equation for incomplete combustion
octane	$2C_8H_{18}(g) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(g)$	$2C_8H_{18}(g) + 13O_2(g) \rightarrow 8CO(g) + 8C(s) + 18H_2O(g)$ *there are other possibilities by changing moles of CO and C*
propene	$2C_3H_6(g) + 9O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$	$2C_3H_6(g) + 5O_2(g) \rightarrow 4CO(g) + 2C(s) + 6H_2O(g)$ *there are other possibilities by changing moles of CO and C*
ethane	$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$	$C_2H_6(g) + 2O_2(g) \rightarrow CO(g) + C(s) + 3H_2O(g)$ *there are other possibilities by changing moles of CO and C*
heptane	$C_7H_{16}(g) + 12O_2(g) \rightarrow 7CO_2(g) + 8H_2O(g)$	$C_7H_{16}(g) + 6O_2(g) \rightarrow 4CO(g) + 3C(s) + 8H_2O(g)$ *there are other possibilities by changing moles of CO and C*
ethene	$C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g)$	$2C_2H_4(g) + 3O_2(g) \rightarrow 2CO(g) + 2C(s) + 4H_2O(g)$ *there are other possibilities by changing moles of CO and C*
hexane	$C_5H_{12}(g) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(g)$	$2C_5H_{12}(g) + 9O_2(g) \rightarrow 6CO(g) + 4C(s) + 12H_2O(g)$ *there are other possibilities by changing moles of CO and C*

1) Complete combustion means the burning of a fuel in a plentiful supply of oxygen gas. The word equation is

fuel + oxygen → carbon dioxide + water + Energy

The flame from the fuel will be invisible, a lot of energy is released.

Incomplete combustion means the burning of a fuel in a limited supply of oxygen gas. The word equation is

fuel + *limited* oxygen → carbon monoxide + carbon + water + a small amount of energy.

The flame from the fuel will be a yellow colour and there will be a black residue left on the object above the flame, only a small amount of energy is released

2) Butane must be burned in a plentiful supply of oxygen so that the poisonous , deadly gas carbon monoxide is not formed. Carbon monoxide binds to the haemoglobin in our blood and prevents oxygen travelling around our body in the blood. The word and balanced equations for <u>in</u>complete combustion of butane are:

butane + *limited supply of* oxygen → carbon monoxide + water + small amount of ENERGY

$$C_4H_{10}(g) + 6O_2(g) \rightarrow 2CO(g) + 2C(s) + 5H_2O(g)$$

there are other possibilities by changing moles of CO and C

The word and balanced equations for complete combustion of butane are:

butane + *plentiful supply of* oxygen → carbon monoxide + water + a lot of ENERGY

$$2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(g)$$

3) The fuel (eg ethanol) is burnt in a plentiful supply of oxygen, there is an invisible flame and the products travel up the funnel and along the tubes. The products of complete combustion are carbon dioxide and water. The cobalt chloride paper tests for water, once the water vapour reaches the blue cobalt chloride paper, the paper turns a pink colour. The limewater tests for carbon dioxide. The pump causes the water vapour and carbon dioxide to be sucked along the tubes and into the test tubes, as a result the carbon dioxide bubbles through the limewater and the limewater changes in colour from a colourless solution to a milky colour.

The general equation for the reaction is fuel + oxygen → carbon dioxide + water + ENERGY

4) The equation for incomplete combustion of ethanol is

incomplete combustion: $2C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO(g) + 2C(s) + 6H_2O(g)$

there are other possibilities by changing moles of CO and C

The equation for incomplete combustion of ethane is

incomplete combustion: $C_2H_6(g) + 2O_2(g) \rightarrow CO(g) + C(s) + 3H_2O(g)$

there are other possibilities by changing moles of CO and C

A comparison is both ethanol and ethane produce carbon monoxide and carbon and water. A difference is that ethanol will produce slightly more energy than ethanol because for every 2 moles of ethanol burnt 3 moles of oxygen are required whereas for ethane for every 2 moles of ethane combusted 4 moles of oxygen gas are required.